**Modularized container services and architecture for medical data processing in the cloud**

**Abstract**

New trends in software engineering are reshaping the computing landscape -- computation is increasingly portable, storage is increasingly elastic, and data accessibility is increasingly ``always on" and ``always available" to an exponentially increasing variety of applications and devices. While the effects of these trends in the larger ``compute-verse" are profound, this paper will discuss and consider how these trends are affecting specifically healthcare informatics. Indeed, end users will experience this trend in applications that are web-centric and mobile-friendly. Such apps will be increasingly used as gateways to powerful backend services (such as analytics and deep learning), while offering local client-side specialization (rich, immersive visualizations and collaborations). The paper offers some perspectives and presents some unmet needs in medical informatics and seeks to provide a viewpoint into how the ``next wave" of computing might present itself. In particular the paper presents a web-based medical image data and information management software platform called CHIPS (Cloud Healthcare Image Processing Service). This cloud-based service uniquely provides an end-to-end service that can connect data from deep within a Hospital securely to the cloud and allow for powerful collaboration -- both on medical image data but also on image processing pipelines, allow for complex processing and enable computational research, and provide a vision of decentralized, large-scale data analysis that can fuel Big Data on medical bioinformatics.

**Presenters**

**Dr. Rudolph Pienaar** I am currently faculty Staff Scientist at the Children's Hospital Boston, where I am the Technical Director of the Fetal-Neonatal Neuroimaging and Development Science Center (FNNDSC). The Center aims to play both a research and clinical role in the Boston's Children's Hospital, and in my capacity at the Center I am engaged in both translational as well as applied research. The goal of the translational research component is to rapidly prototype and deploy complex research-based software within a clinical setting. To this end I head up a small team developing simple interfaces to creating, managing, and using a wide array of research software, as well as optimizing design and execution of the same. My applied research explores and models the basic processes underpinning human brain development, especially the shape of cortical surfaces and the role this can play in development and disease. Related interests are white matter tractography, specifically the propagation and flow of information through brain networks, as well as investigating relationships between cortical surface markers and internal fiber organization.

**Dr. Ellen Grant** holds a Master of Science degree in physics and an MD from the University of Toronto. She did her radiology residency at Vancouver General Hospital in British Columbia, Canada, and her fellowship in adult and pediatric neuroradiology at the University of California, San Francisco. She is now Professor of Pediatrics and Radiology at the Harvard Medical School. Dr. Grant headed the Division of Pediatric Radiology at Massachusetts General Hospital for five years before moving to Children's Hospital Boston to become the founding director of the Fetal-Neonatal Neuroimaging and Developmental Science Center (FNNDSC) in 2009. The Center has grown to over 80 people with active research in Magnetic Resonance Imaging (MRI), Near Infrared Spectroscopy (NIRS), Magnetoencephalography (MEG) and Imaging Informatics. She is the first incumbent of Children's

Hospital Boston Chair in Neonatology. At Children's she holds appointments in the Departments of Medicine and Radiology. Dr. Grant is a co-author of two popular textbooks for clinical neuroradiology and has won a number of awards for her research efforts as well as recognition for her clinical excellence. She is currently PI on 5 active NIH grants and has authored over 170 papers.

**Yangming Ou**

My interests and expertise are in medical image analysis algorithms (registration, segmentation, pattern recognition) and their applications in translational research (brain/breast/prostate oncology, CAD, neuro-degeneration, pediatric/mouse brain growth). The Research page introduces the related research projects where I made primary or important contributions.

I obtained my **Ph.D.** degree in Bioengineering (UPenn, 12/2012), advised by Prof. Christos Davatzikos and other committee members Prof. Andrew Maidment, Prof. Nikos Paragios, Prof. Timothy Roberts and Prof. Paul Yushkevich. Previous degrees include **MA** in Applied Maths (UPenn, 05/2009) and **BS** in Electrical Engineering, BME division (Tsinghua, 07/2003).

In the field of medical imaging and medical image analysis, I have ~10 years of work/research experience. I worked in **academia** (*research fellow*in SBIA at UPenn, 2006-2012; *visiting scholar* in Ecole Centrale de Paris, Paris, France, 04-06/2010), in **industry** (*summer intern*, CAD Group at Siemens Medical Solutions, Malvern, PA, 06-08/2005), and in **hospitals** (*clinical rotation* in Surgical Anatomy and Radiology, Wake Forest Baptist Medical Center, Winston-Salem, NC, 05/2010; *imaging technician*, Radiology Department at the People's Hospital in Tibet, Lhasa, Tibet, 2003-2004).